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ABSTRACT

A model of teacher education was developed as a result of a team project at Teachers College, Columbia University, in which substantive and clinical work were unified in a design constructed about a series of models of teaching. The design equips the young teacher with the theoretical and clinical capacity to understand and bring into existence a repertory of teaching strategies based on theoretical conceptions. Twenty-six candidates were exposed to the instructional systems built around three models of teaching during the fall of 1970. The models were Synectics, Concept-Attainment, and Group Investigation. The candidates practiced the models in the classroom in which they were student teaching, observers coded their teaching behavior, and the response of their students using the Teacher Innovator System. Behavior was also rated in terms of the specifications of each of the models. Samples of the teaching behavior of each teacher candidate were obtained when he was not practicing the models of teaching as well as samples of teaching episodes of the cooperating teachers. Tables indicate the many results found. A 29-item bibliography, appendixes, and illustrations are included. (MJM)

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MODELS OF TEACHING AS A PARADIGM FOR TEACHING EDUCATION

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Part I: Background and Rationale

The research reported herein originated conceptually with the Bureau of Research's Teacher Education projects in 1968 and 1969. As part of this project a team working at Teachers College, Columbia University developed a model of teacher education in which substantive and clinical work were unified in a design constructed around a series of models of teaching (1) (2) (3). In the years since the original conception was developed, modifications have been made, a considerable quantity of software has been developed, and many of the elements of this model of teaching education have been implemented in the preservice program at Teachers College.

The essence of the design is to equip the young teacher with the theoretical and clinical capacity to understand and bring into existence a repertory of teaching strategies based on theoretical conceptions. These theoretical conceptions are what is referred to as "Models of Teaching" (3).

Identification of the Models

Educators, psychologists, sociologists, systems analysts, psychiatrists, and many others have produced theoretical positions about learning and teaching. Curriculum development projects, schools and school districts and organizations representing particular curriculum areas or disciplines have also developed a large number of approaches to teaching and learning. The task of selection began with the development of a very long list of sources of models. Included on the list were the works of counselors and therapists, such as Carl Rogers (4), Erik Erikson (5), and Abraham Maslow (6). Included also were learning theorists such as Skinner (7), Ausubel (8), and Bruner (9). The works of developmental psychologists such as Piaget (10), Kohlberg (11), Hunt (12), and others were identified. Philosophers such as Dewey (13), James (14), and Broudy (15) were included. Curriculum development projects in the academic subjects provided many examples. Specialists in group dynamics contributed models. The patterns of teaching from the great experimental schools, such as Summerhill, made their way onto our list. Altogether, more than eighty theorists, schools and projects were identified on the initial list.

As we examined the patterns of teaching from our first list, we discarded some because they seemed too vague to provide general models that could be communicated to a good many people. Others were eliminated because the advocates or developers of

the models, while they were explicit enough about the specific things that teachers or curriculums should do, paid inadequate attention to a rationalization for their model, so that it was not easy to tell why they advocated it, or why it could be reasonably expected to achieve its intended aims. The remaining models fit the criteria of being communicable and rationalized.

Grouping the Models

Gradually, we began to group the models on the basis of the sources of reality which theorists drew on as they focussed on the learner and his environment. Eventually we organized the models into four families which represented different orientations toward man and his universe. Although there was much overlap among families (and among models within families), the four were: (1) those oriented toward social relations and toward the relation between man and his culture and which draw upon social sources, (2) those which drew on information processing systems and descriptions of human capacity for processing information, (3) those which drew on personality development, the processes of personal construction of reality and the capacity to function as an integrated personality as the major source; (4) those developed from an analyses of the processes by which human behavior is shaped and reinforced. At length we decided to organize this book around exemplars of these families. Let us define these sources more fully:

(1) The Social Interaction Sources

These sources emphasize the relationships of the person to his society or his direct relationships with other people. They reflect a view of human nature which gives priority to social relations and the creation of a better society. They see the processes by which reality is socially negotiated as vitally important in the life of man. With respect to goals, consequently, models from this orientation were directed toward the improvement of the individual's ability to relate to others. Many of them developed from a desire to improve democratic processes and to educate students to improve the society. It must be stressed that the social relations orientation does not assume that social relations is the only important dimension of life. Social relations may be emphasized more than other domains, but social theorists are usually concerned with the development of the mind, and the development of the self, and the learning of academic subjects. Some of them, of course, have developed models specifically for the improvement of social relations or they use social relationships as the primary vehicle of education, but it is the rare theorist in education who is not concerned with more than one aspect of the learner's development, or who does not use more than one aspect of the environment to influence the learner's development.

(2) The Information-Processing Sources

The second large family of models shares an orientation toward the information-processing capability of the

student and systems which can be taught him so as to improve his information-processing capability. By information-processing we mean the ways people handle stimuli from the environment, organize data, sense problems, generate concepts and solutions to problems, and employ verbal and non-verbal symbols. Some of these models are concerned with the ability of the learner to solve certain kinds of problems and use studies of problem solving as a major source. Others concentrate on creativity and yet others are concerned with general intellectual ability. Some emphasize the teaching of specific strategies for thinking, creative thinking, and thinking within academic disciplines. Again, however, it must be stressed that nearly all models from this family are also concerned with social relationships, and the development of an integrated, functioning self. Yet, their primary sources are the student's capacity to integrate information and to process it, and systems, especially academic systems, which can help individuals to process data. We refer to them as information-processing oriented models.

(3) The Personal Sources

The third family shares an orientation toward the individual person as the source of educational ideas. Then frames of reference spotlight personal development and they emphasize the processes by which the individual constructs and organizes his reality. Frequently they emphasize the personal psychology and the emotional life of the individual. These

models are directed toward the individual's internal organization as it affects relationships with his environment and himself. Some are concerned with his personality and with his capacity to reach out fearlessly into his milieu to make contact with others, and to venture where he has not been before. Others are more oriented toward his feelings about himself, toward his self-concept, or his self-image. Yet others are concerned with helping him develop an authentic reality-oriented view of himself and his society. Again, it is necessary to note that most of the models which are oriented around the development of the self are also concerned with the development of social relations and information-processing capacity. The distinctive feature of this category is the emphasis on personal development as a source of educational ideas. It is more that the focus of educational goals and means is on the self, at least as the avenue toward other aspects of development, rather than a view that the person is not a processor or an interactor with others. Hence, while the focus is on helping the person develop a productive relationship with his environment and to view himself as a capable person, it is expected that one of the products of that will be richer interpersonal relations, and a more effective information-processing capacity. We refer to this family as the person-oriented family.

(4) Behavior Modification as a Source

This fourth source of models has developed from attempts to develop efficient systems for sequencing

learning attitudes and shaping behavior by manipulating reinforcement. Students of reinforcement theory, such as B. F. Skinner (7), have developed these models and operant conditioning is their central procedure. They frequently are referred to as behavior modification theories because of their reliance on changing the external behavior of the student and their description of him in terms of extremely visible behavior rather than underlying and unobservable behavior.

Operant conditioning has been applied to a wide variety of educational goals, ranging from military training to interpersonal behavior and even to goals of therapy. Its general applicability has lead to its use in many domains of human behavior which characterize the other families of models.

Relationships Among the Four Families

Our families of models, therefore, are by no means antithetical to one another, and the actual prescriptions for developing learning environments that emerge from some of them are remarkably similar although we classified them into different families. Also, within the families certain of the models share many features, both with respect to goals and with respect to the kinds of means that they recommend.

A list of the models included in this book, classified by family, and annotated briefly, follows as Table One.

TABLE ONE

THE MODELS OF TEACHING
CLASSIFIED BY FAMILY AND MISSION

	MODEL	MAJOR THEORIST	FAMILY OR ORIENTATION	MISSIONS OR GOALS FOR WHICH APPLICABLE
1.	Inductive Model	Hilda Taba	Information Processing	Primarily for development of inductive mental processes and academic reasoning or theory building but these capacities are useful for personal and social goals as well.
2.	Inquiry Training	Richard Suchman	Information Processing	
3.	Science Inquiry Model	Joseph J. Schwab (also much of the Curriculum Reform Movement, see Jerome Bruner The Process of Education for the rationale)	Information Processing	Designed to teach the research system of the discipline but also expected to have effects in other domains (i.e. sociological methods may be taught in order to increase social understanding and social problem-solving).
4.	Jurisprudential Teaching Model	Donald Oliver and James P. Shaver	Information Processing	Designed primarily to teach the jurisprudential frame of reference as a way of processing information but also as a way of thinking about and resolving social issues.
5.	Concept Attainment	Jerome Bruner	Information Processing	Designed primarily to develop inductive reasoning.
6.	Developmental Model	Jean Piaget Irving Sigel Edmund Sullivan	Information Processing	Designed to increase general intellectual development especially logical reasoning but can be applied to social and moral development as well. (See Kohlberg)

TABLE ONE (con't)

	MODEL	MAJOR THEORIST	FAMILY OR ORIENTATION	MISSIONS OR GOALS FOR WHICH APPLICABLE
7.	Advance Organizer Model	David Ausubel	Information Processing	Designed to increase the efficiency of information processing capacities to meaningfully absorb and relate bodies of knowledge.
8.	Group Investigation	Herbert Thelen John Dewey	Social Interaction	Development of skills for participation in democratic social process through combined emphasis on interpersonal social (group) skills and academic inquiry. Aspects of personal development are important outgrowths of this model
9.	Social Inquiry	Byron Massialas Benjamin Cox	Social Interaction	Social problem-solving primarily through academic inquiry and logical reasoning.
10.	Laboratory Method	National Training Laboratory (NTL) Bethel, Maine	Social Interaction	Development of interpersonal and group skills and through this personal awareness and flexibility.
11.	Non-Directive Teaching	Carl Rogers	Person	Emphasis on building capacity for self-instruction and through this personal development in terms of self-understanding, self-discovery and self-condept.
12.	Classroom Meeting Model	William Glasser	Person	Development of self-understanding and self-responsibility. This would have latent benefits to other kinds of functioning i.e. social.

TABLE ONE (con't)

	MODEL	MAJOR THEORIST	FAMILY OF ORIENTATION	MISSIONS OR GOALS FOR WHICH APPLICABLE
13.	Awareness Training	William Schutz Fritz Perls	Person	Increasing personal capacity for self exploration and self-awareness. Much emphasis on development of interpersonal awareness and understanding.
14.	Synectics	William Gordon	Person	Personal development of creativity and creative problem-solving.
15.	Conceptual Systems Model	David E. Hunt	Person	Designed to increase personal complexity and flexibility.
16.	Operant Conditioning	B.F. Skinner	Behavior Modification	General applicability. A domain-free approach though probably most applicable to informatic processing functioning.

How Models are Described and Operationalized

Several concepts are used in describing and operationalizing a model of teaching.

Orientation or Focus

In order to describe the models as explicitly as we could so they would be useful to a diverse clientele of education, and to avoid doing violence to the original theories, we depicted the orientation or focus of each model, that is, the model's theses, the kinds of goals the model builder focuses on and the reason he believes that the particular means would be likely to achieve those goals.

Structure or Syntax

The structure involves a description of the model in action. If a teacher were to use the model as the basis for his strategy, how would he begin a lesson? What would he do first, second, third? What would he keep in mind as he responded to the activity of the learner? For example, one model begins with a presentation to the learner of a concept that is called an "advanced organizer." This concept is given to the student verbally. In the second phase, the material to be learned is presented to the learner. This phase is followed by another in which the learner is helped to relate the material to the specific conept. These phases make up the structure or syntax of the model, the flow of events designed to influence the student or help him teach himself. In a different model the first phase includes data collection by the students, then an organization of the concepts developed with those developed by other people. These two models have a very different structure or set of phases, even though the same type of concept might emerge from both models,and they were, in fact, designed for somewhat different purposes, although both belong to the information processing family. The first was designed for the mastery of material, and the second to teach students inductive thinking processes.

By comparing the structural phasing of models we are able to identify the operational differences between them and to make clear the roles a training agent must fulfill in order to make a model work. In Illustrative Model #2, for example, a teacher

(or a mechanical agent) must trigger the concept building activity of the second phase and shift the student's attention from the collection and identification of data to the development of

Figure One

Illustration of Phasing in Models

	Phase One	Phase Two	Phase Three
Illustrative Model #1	Presentation of Concept	Presentation of Data	Relating of Data to Concepts
Illustrative Model #2	Presentation of Data	Development of Categories by Students	Identification and Naming of Concepts

concepts which group and otherwise make the data comprehensible.

Principles of Reaction

Some models provide the teacher with principles to guide his reaction to student activity. In Illustrative Model #2, the teacher during Phase Two might reward concept-building activity and encourage students to compare their concepts. In some models the teacher overtly tries to shape behavior by rewarding some student activities and maintaining a neutral stance toward others. In others the teacher tries not to manipulate rewards, but maintain carefully equal status with his students.

These principles help the teacher select the reactions he will

make as his interaction with the students emerges. They provide him with rules of thumb by which he can gauge the student and select his responses to what the student does.

The Social System Specified by the Model

We also felt it was important to describe the model's social system. To do so we used three subconcepts: a description of student-teacher roles, a description of the hierarchical or authority relationships, and a description of the kinds of norms which are encouraged (the student behavior which is rewarded). The leadership roles of the teacher vary greatly. In some models he is reflector or facilitator of group activity, in others a counselor of individuals, and still others a taskmaster. The second concept, hierarchical relationships, is explained in terms of the sharing of initiatory activity by teacher and learner, the location of authority, and the amount of control over activity that emerges from the process of interaction. Some models use the teacher as the center of activity and the source of input: he is the organizer and pacer in the situation. Others provide for relatively equal distribution of activity between teacher and student, while some place the student at the center. Finally, different kinds of student behavior are rewarded in different models. In some the student is rewarded for getting a job done and sticking to a prescribed line of inquiry. In others he rewards himself by knowing that he has learned something.

One way to describe a teaching model is according to the

degree the learning environment is structured. That is, as roles, relationships, norms, and activities become less prescribed or externally imposed, and more emergent and within the students' control, we can say that its social system is less structured.

Support System Specified by the Model

Another question we ask is what support was needed in order to create the environment specified by the model? That is, what are the additional requirements beyond the usual human skills and capacities and technical facilities? For example, the human relations model may require a trained leader, the non-directive model may require a particular personality, i.e., an exceedingly patient, supportive one. Suppose that a model postulates that students should teach themselves with the roles of teachers limited to consultation and facilitation. What support is necessary? Certainly a classroom filled only with textbooks would be limiting and prescriptive. Rather, support in the form of books, films, self-instructional systems, travel arrangements, and the like is necessary.

The support requirements are derived from two sources - the role specifications for the teacher and the demands of the substantive nature of the experiences. Support requirements are real. Many able educational programs fail because of failure to consider or anticipate the support requirements. As a result, we feel that considering the support system is as much a part of making a model happen as learning the model itself.

Instructional Systems

Models of Teaching

The teacher education program is designed to introduce students to models of teaching representing each of the four families. In order to accomplish this, instructional systems have been developed around each of several models which are used as exemplars of the families (16). These instructional systems employ several media and each one is organized as follows:

1. Stage One constitutes an exploration of the theory of the model. For example, in the instructional system which teaches the skills of role playing the theory of role-playing is studied by reading works of the Shaftels and others who have developed approaches to role-playing for social values. The readings are combined with discussions and exercises comparing the theories with one another.
2. Stage Two demonstrates the model. Television tapes, transcripts and descriptions of learning activities are combined and are analyzed to explore the dynamics of the model of teaching in action.
3. Stage Three involves peer teaching. In this phase, student teachers teach one another using materials which have been prepared for them beforehand. This phase is designed to provide preliminary practice in the model, and also to help each person understand what it feels like to be a student in the model situation.
4. Stage Four is microteaching practice with small groups of

children using materials which have been prepared in advance. Trainees take turns observing one another and television recordings are used to facilitate feedback for the development of precision in the model of teaching.

5. The Fifth Stage consists of <u>application</u> to a normal classroom situation through practice at first with materials supplied to the trainee and later with materials he prepares himself.

Figure Two

Stages in Instructional Systems

Stage I	Stage II	Stage III	Stage IV	Stage V
Theory	Demonstration	Peer Teaching	Micro teaching	Classroom Application

In addition to the systems for teaching models of teaching, a series of instructional systems have been designed to provide instruction in a set of teaching skills which logically will facilitate the learning of the models. (16) A brief description of these skills and the system to teach them follows.

Basic Teaching Skills

We can think of a teaching skill as a distinct set of isolatable behaviors that affect the learning by supporting and guiding him in his inquiry. These such skills include, for example, reinforcing student performance. Since there are many ways to reinforce student performance, skill in reinforcement means that the teacher masters several behaviors. Such mastery implies that the teacher can call on these behaviors at will.

We have identified three skills that are widely useful and affect the intellectual activity, social relations, and content of the learning environment. The skills are structuring, modulating cognitive level, and focusing.

Structuring, as a skill, influences the social dimension of the learning environment, the relations among people. There are many aspects of social relationships and many ways to look at them. They may be viewed in terms of behaviors that give rise to roles; for example, the student may be the recipient of information and the teacher the source of information. Relationships can also be viewed in terms of their emotional qualities or in terms of those behaviors that are rewarded and those that are punished. The skill of structuring is concerned with varying the distribution of control over behavior in the relationship between teacher and students. To what extent is behavior directed by the students? We can determine this by looking at who controls the organization of the learning activity -- who determines the goals, the content and form, and the

pacing, and who initiates and maintains the activity. When teacher and student share most of these decisions and responsibilities, the structure is negotiated; when they are determined primarily by the teacher, it is teacher-directed; and when students make all these decisions and maintain the activity; it is student-constructed.

Modulating affects the intellectual activity that characterizes the learning environment. This skill is concerned with the way in which any data or content is handled. The levels of cognitive activity -- factual, conceptual, theoretical -- can be described along a continuum beginning with the identification of data and extending to the building of concepts and theoretical processing of data. To modulate cognitive level is to establish a certain type of intellectual activity and change it when appropriate. Modulation of cognitive level can be accomplished chiefly through designing activities and asking questions.

Focusing affects the content of the learning environment. Learning activities at each cognitive level can deal with many aspects of social life and behavior. The general topic of family, for example, can be studied from an economic perspective or from a sociological perspective (for example, an analysis of its roles and norms). Focusing is used by the teacher to draw, maintain, or shift the students' attention to a particular aspect of the topic or learning activity. This can be done by designating content, selecting materials, asking questions, or making statements. In our conceptualization of this skill we

present a way of looking at social studies content so that these focusing activities can take place systematically.

While strategies provide a design for the learning environment, skills enable a teacher to bring that design into existence. Each Model of Teaching can be described in terms of these three basic skills.

Interaction Analysis

In another instructional system (17) teacher candidates are taught the Teacher Innovator System for Analyzing Skills and Strategies, a process analyzer system which can be used to describe and analyze teaching behavior in terms which relate to the various models of teaching and the teaching skills. In addition, sets of workshops are conducted to apply the models over the various curriculum areas, and apprenticeship to classrooms continues throughout the year. The culminating experience of the program is a summer school for neighborhood children which is conducted by the teacher candidates. They are responsible for organizing a community "board" to legitimize the school, for designing the curriculum, and training themselves to carry it out. They build it around learning centers constructed around various models of teaching (18).

Program Design and Instructional Systems

In Figure 3 the relationship of the major components of the program is identified.

Figure Three

The Structure of the Teacher-Innovator

Skills Components	Models Components	Study of Teaching Component	Work-shops	Experimental Summer School
I II III	I II III IV			

In Figure 4 the schedule of the components is given. The program begins with the teaching of the interaction analysis system followed by the three basic teaching skills and then, in turn, each of the models of teaching is explored. The work-shops begin to appear after the first pair of models have been taught so that they can be applied to the various curriculum areas. Concomitant with this is the student teaching experience which is a part-time experience during the fall and increasing in the spring to a variety of intensive combinations. The curriculum seminar deals with the creation of the summer school, so this provides a planning opportunity as well as an exploration of alternative models of schooling and the process by which a model of teaching is applied to the creation of an environment larger than the classroom. The summer school completes the program.

Reliability

Interaction Analysis data using the Joyce System of Interaction Analysis was the primary basis of the data used in this study. Coding reliability scores were obtained by having observers each code several transcripts. Frequencies for each category were calculated and ordered Pairs of rank-order correlations were calculated and computed. The rank-order correlations ranged from .85 to .93.

Figure Four

The Program Components

	Semester One	Semester Two	Summer
Field Experience	Part Time	2/3 time	Trainee-operated school
Clinical Training	Skills 1,2,3 Models 1,2	Models 3,4	
Study of Teaching	Classroom Behavior Analysis	with television recording	
Subject Workshops	Reading, Social Studies	Reading, Social Studies	
Courses	Mathematics Psychology Philosophy	Science, Curriculum	

The rationale of the program stems from the belief that the basic methodologies of education are theoretical specifications of learning environments (Models of Teaching), and the program is structured to explore a variety of learning environments, their theoretical bases, and to develop the clinical repertory necessary to carry them out. The concomitant rationale is that theory and practice should be taught simultaneously. Hence the structure of the modules for teaching the models of teaching describe both theory and practice and the two are linked in the instructional systems in such a way that apply the model very close in time to the point where they begin to study it.

Another aspect of the rationale is that the teacher as an institution builder should be emphasized equally with the processes of interactive teacher (19). The Summer school experience is the most prominent component devoted to the processes of institution building. It requires the students not only to teach within a classroom environment but to create the institutional matrix within which they will work, at least for that six to eight weeks' summer period.

The major behavioral output of the program is in terms of the repertory of developed conceptions of teaching and the clinical ability to actualize them. The good teacher is defined as one with the capacity to actualize learning environments representing each of the families of models of teaching.

The Structure of the Research into the Models of Teaching

The questions which we have attempted to face in structuring research into teacher education built around the conceptions of the models of teaching are: (1) whether it is indeed possible to teach young teachers a repertory of teaching models to a sufficient extent that they can actualize them in the classroom; and, (2) if so, what factors contribute to the ability to implement a model of teaching?

Questions Asked

The following series of questions structure the research:

1. Do student teachers, when attempting to actualize models of teaching, create interactive teaching patterns which are different from those manifested when they are not practicing the models and which approximate the theoretical specifications of the learning environment contained within each of the models? (Part II)
2. Is the teaching behavior of cooperating teachers related to the patterns which are manifested when the models are practiced? (Part III)
3. How does the level of children taught (primary or intermediate) influence the interactive patterns which are created? (Part IV)
4. Are personality variables, attitudes, and values factors in the actualization of the models of teaching? (For example, can students whose orientation is child-centered learn models which use a good deal of external structure,

and can students whose orientation is toward structured models learn to actualize models built around student activity?) Stated in terms of the families of teaching models, the fundamental question is whether those with a philosophical preference for one family or another can participate in the teaching of models drawn from the other families. Since there are very real philosophical differences among the families of models, this is a serious question of both practical and philosophical import. (Part V)

General Procedures

Twenty-six teacher candidates were exposed to the instructional systems built around three models of teaching during the fall of 1970 as a part of the teacher education program described above. The models were: Synectics, Concept-Attainment, and Group Investigation. Those models were selected because they require distinctly different patterns of teaching from each other and from normal patterns of teaching. When they practiced the models in the classrooms in which they were student teaching (Stage Five of the Instructional System), observers coded their teaching behavior and the responses of their students using the Teacher Innovator System. The teacher-candidates' behavior was also rated in terms of the specifications of each of the models. In addition, samples of the teaching behavior of each teacher candidate were obtained when he was not practicing the models of teaching as well as samples of teaching episodes of the cooperating teachers.

Twenty-five teacher candidates also completed the Sentence

Completion Test, Allport/Vernon/Lindzey Study of Values, Wehling/ Charters Inventory of Teacher Conceptions of the Educative Process, and the Kraitlow/Dreier Inventory - A Scale for Determining Teacher Beliefs. These inventories will be discussed later.

The above yielded data were analyzed in terms of the two questions. Specific procedures will be discussed in relation to the questions.

The Coding System

The Teacher-Innovator System consists of fifty-nine categories for coding teacher and student behavior (see Appendix A for descriptions of the present system) in four major dimensions, Sanctioning (rewarding and punishing), Information Processing (Questions and Statements over seven levels of cognitive functioning), Structuring (Developing and negotiating Procedures) and Maintaining the Social System. Twenty-five of the categories refer to student behavior and thirty-five to teacher behavior.

Nine indices, derived from the Teacher-Innovator categories, are employed in the analysis of the data related to the primary questions of the study. Each index refers to an aspect of teacher or learner behavior which we believe to be an important descriptor of teaching style. Some refer to general aspects of teaching behavior and others are "model-relevant." That is, they describe aspects of teaching behavior which are prominent in the descriptions of the various models.

Index One. Teacher Talk. (Ratio to all talk) Relevant to Group Investigation and Synectics.

Index Two. Negotiated Structuring, Teacher. (Ratio to all talk). Relevant to Group Investigation.

Index Three. Negotiated Structuring, Student. (Ratio to all talk). Relevant to Group Investigation.

Index Four. Higher Level Information Processing. (Ratio to all information processing). Relevant to Synectics.

Index Five. Middle Level Information Processing. (Ratio to all information processing). Relevant to Concept Learning.

Index Six. Positive Sanctioning of Higher Level Processes. (Ratio to all talk.) Relevant to Synectics, Concept-Learning.

Index Seven. Negative Sanctioning of Higher Level Processes. (Ratio to all talk). Relevant to Synectics and Concept Learning).

Index Eight. Information Processing (Ratio to all talk). General Indicator of Style.

Index Nine. Procedural (Ratio to all talk.) General Indicator of Style.

The computation of the Indices is described in Appendix B.

Part II: Influence of Models of Teaching on Interactive Teaching Patterns: Pattern Comparisons

The first question asked is whether the indicators of teaching behavior calculated when the teacher candidates were practicing the models were significantly different from their "normal" or "non-model" teaching styles and, especially, whether the differences were in the desired directions according to the model-relevant indices.

Non-Model Teaching Behavior

Table Two presents the mean percent for all fifty-nine categories during the "non-model" lessons in which the teacher candidates presumably employed their "normal" teaching styles, or at least were not practicing models formally. Several features of the frequency distributions are worth commenting on.

-TABLE 2-

MEAN PERCENTAGES OF SUB-CATEGORIES IN NON-MODEL LESSONS OF TEACHER CANDIDATES

General Category: Sanctioning	%
T rewards lower mental activity	3.82
T punishes " " "	0.71
T rewards higher " "	0.88
T punished higher " "	0.11
T rewards group relations	0.03
T punishes " "	0.13
T rewards following directions	0.09
T punishes " "	1.48
T generally supportive	0.44
T generally punishing	0.13
S rewards	0.05
S punishes	0.97
SUB-TOTAL	8.84

General Category: Information	
T question memory level	8.81
T statement " "	7.27
S question " "	0.85
S statement " "	12.07
T question translation level	6.35
T statement " "	3.88
S question " "	0.37
S statement " "	9.71
T question interpretation level	3.20
T statement " "	0.91
S question " "	0.05
S statement " "	2.96
T question application level	0.68
T statement " "	0.09
S question " "	0.00
S statement " "	0.61
T question analysis level	0.33
T statement " "	0.13
S question " "	0.01
S statement " "	0.25
T question synthesis level	0.21
T statement " "	0.02
S question " "	0.00
S statement " "	0.25
T question evaluation level	0.11
T statement " "	0.00
S question " "	0.00
S statement " "	0.02
SUB-TOTAL	59.14

General Category: Opinioning	%
T asks for opinion	0.81
T gives opinion	0.26
S asks for opinion	0.01
S gives opinion	1.65
SUB-TOTAL	2.73

General Category: Procedures	
T directs procedures	11.65
S " "	2.18
T negotiates procedures	3.05
S " "	1.65
T directs standards	0.04
S " "	0.03
T negotiates "	0.05
S " "	0.05
SUB-TOTAL	18.70

General Category: Maintenance	
T provides transition	3.79
S " "	0.05
T makes small talk	0.43
S " " "	2.32
T discusses routine	0.07
S discusses "	0.03
T repeat by teacher	3.89
SUB-TOTAL	10.58

TOTAL	99.99

TABLE TWO-A

MEAN PERCENTAGES OF SANCTIONING IN NON-MODEL LESSONS (% of all communication)

	T E A C H E R					S T U D E N T	
	LOWER MENTAL ACTIVITY	HIGHER MENTAL ACTIVITY	GROUP RELATIONS	FOLLOWING DIRECTIONS	GENERAL		TOTAL SANCTIONS
REWARDS (POSITIVE)	3.82	0.88	0.03	0.09	0.44	0.05	5.31
PUNISHES (NEGATIVE)	0.71	0.11	0.13	1.48	0.13	0.97	3.53
TOTAL	4.53	0.99	0.16	1.57	0.57	1.02	8.84

Sanctioning

Rewards were directed toward lower cognitive activity (Category One) more than higher activity (Category Three). Students rarely rewarded others (Category Eleven) but occasionally made punitive statements (Category Twelve) about one per cent of all communications. (Table Two-A)

Information-Handling

The low percentage of student-asked questions accords with many previous studies of the classroom (only 1.3% of all communications) and the rarity of the Higher Cognitive Levels is typical. It is worth noting that the proportions of teacher questions and student statements at each cognitive level are similar. In general, the latter were responses to the former.

TABLE TWO-B

Information Processing:

Cognitive levels of Teacher Questions and Student Statements in "Non-Model" Episodes.
(% of all talk)

Level	Cognitive Activity	Teacher Questions	Student Statements
1	Memory	8.81 %	12.07 %
2	Translation	6.35	9.71
3	Interpretation	3.20	2.96
4	Application	.68	.61
5	Analyses	.33	.25
6	Syntheses	.21	.25
7	Evaluation	.11	.02
TOTALS		19.69	25.87

TABLE TWO-C

MEAN PERCENTAGES OF STRUCTURING IN
NON-MODEL LESSONS (% of all talk)

	T E A C H E R		S T U D E N T		
	DIRECTED	NEGOTIATED	DIRECTED	NEGOTIATED	TOTAL
PROCEDURES	11.65	3.05	2.18	1.65	18.53
STANDARDS	.04	.05	.03	.05	.17
TOTAL	11.69	3.10	2.21	1.70	18.70

The low percentage of synthesis-level communications (Level 6) is noteworthy because it is an essential feature of Synectics. Thus, implementation of Synectics requires a level which was unusual in the non-model situations.

Structuring

Teacher-directed communications dominate (see Table Two-C), although student-participation is higher than one obtains in samples of experienced teachers. Again this is noteworthy because one of the models - Group Investigation - requires a very high level of negotiated structuring.

Appendix C presents the mean percentages of subcategories for both non-model and model lessons. The remaining analysis of model and non-model behavior is based on comparisons of the nine indices rather than individual subcategories.

Patterns of Behavior when Experimenting with the Models

The nine indices were calculated for each teacher candidate and we will ask the same question with respect to each model: "Were the indices different from the normal teaching styles?" Especially, "Were the model-relevant indices different in the predicted directions?"

Synectics

Synectics is a highly structured teaching strategy which emphasizes metaphoric thinking. It culminates with the deliberate use of analogies to attack problems. The conceptualization of

TABLE THREE

COMPARISON OF MEANS OF NINE INDICES OF CLASSROOM INTERACTION FOR SYNECTICS MODEL TEACHING AND NON MODEL EPISODES

Index No.	Name	Mean Syntectics	Mean Non-Model	S.D. Synectics	S.D. Non-Model	T
1	Teacher Talk	0.565	0.638	0.044	0.053	-5.277**
2	Negotiates Structuring Teacher	0.012	0.030	0.010	0.027	-3.067**
3	Negotiates Structuring Student	0.007	0.016	0.007	0.015	-2.541
+4	Higher Level Information Processing	0.273	0.045	0.163	0.046	6.857*
+5	Middle Level Information Processing	0.190	0.115	0.081	0.082	3.288*
+6	Positive Sanctioning	0.032	0.052	0.025	0.024	-2.869*
+7	Negative Sanctioning	0.020	0.025	0.016	0.014	-1.157
8	Information Processing	0.591	0.590	0.134	0.085	0.007
9	Procedural	0.123	0.186	0.046	0.071	-3.782**

+Model-Relevant Index

**Indicates significance at the .01 level for a two-tailed test. Critical *t* with 50 df = $\pm$2.68

*Indicates significance at the .01 level for a one-tailed test. Critical *t* with 50 df = $\pm$ 2.40

problems, synthesis of metaphors, and application of metaphors are critical in Synectics.

The model should result in a great deal of Higher Level Information Processing (Index 4) and Middle-Level Information Processing (Index 5). Because it is a model of creative thinking, there should be a low evaluative atmosphere, particularly negative sanctioning. (Indices 6 and 7). Thus, these four are the model-relevant indices for Synectics. The model, however, should also reduce teacher talk and affect procedural interaction by reducing it somewhat. Table Three presents the mean indices computed for Synectics compared with "non model" practice.

The primary model-relevant index was Index Four, Higher-Level communications; the Synectics model requires much activity at this level. This index rose significantly, with seven times as much activity in the Higher Levels as in the normal teaching sessions. (In terms of synthesis-level [Level Six] communication alone--the most prominent feature of Synectics activity. Appendix C shows that the percentages for Level Six communications were 6.3 for teachers and 5.6 for students, indicating that 11.9% of all communication was at that level while Synectics models were being practiced as compared with less than one half of one percent during "normal" teaching.)

Attention to procedures dropped (Index Nine) as did negotiated teacher structuring (Index Two), for Synectics is a teacher-directed model, at least in the early stages. Teacher Talk (Index One) dropped significantly (about 10%). This probably reflects the effects of the increase in higher-order questions by teachers. Higher-Level solicitations generally result in greater proportion of

student talk in response for the more complex questions often require discussion and debate and permit more alternative responses. In fact, the ten percent shift here is actually smaller than one would expect had the teachers allowed full response to the solicitations. Positive sanctioning decreased significantly and negative sanctioning decreased slightly, both indices moving in the direction one would expect in a Creative Thinking Model that cautions against external evaluation.

Concept Attainment

Concept Attainment is another directive strategy which emphasizes Higher Level thinking; especially at the interpretation level (Cognitive Level 3)which reflects the analyses of concepts.

In Table Four the indices computed from Concept-Attainment practice are compared with "non model" practice.

Student participation in the structuring of procedures (Index Three) dropped significantly, as did attention to procedures in general (Index Nine). The critical model-relevant index was Index Five (Middle Level cognitive activity) and this rose significantly as did Higher-Level Information Processing (Index Four). The proportion of Middle-Level activity (Interpretation Level 3) nearly doubled (.115 to .190) when the Concept-Attainment model was being practiced. Specifically, the categories associated with that level changed as follows (see Table Five):

TABLE FOUR

COMPARISON OF MEANS OF NINE INDICES OF CLASSROOM INTERACTION FOR CONCEPT ATTAINMENT TEACHING AND NON-MODEL EPISODES

Index No.	Name	Mean Concept Attainment	Mean for Non-Model	SD. Concept Attainment	S.D. Non-Model	T
1	Teacher Talk	0.636	0.638	0.044	0.053	-0.109
2	Negotiates Structuring Teacher	0.021	0.030	0.015	0.027	-1.417
3	Negotiates Structuring Student	0.005	0.016	0.005	0.015	-3.264**
+4	Higher Level Information Processing	0.074	0.045	0.038	0.046	2.470*
+5	Middle Level Information Processing	0.190	0.115	0.070	0.082	3.525*
6	Positive Sanctioning	0.051	0.052	0.023	0.024	-0.057
7	Negative Sanctioning	0.022	0.025	0.014	0.014	-0.529
8	Information Processing	0.637	0.590	0.075	0.085	2.089
9	Procedural	0.122	0.186	0.055	0.071	-3.611**

+Model Relevant Index

**Indicates significance at the .01 level for a two-tailed test. Critical *t* with 50 df = $\pm$ 2.68

*Indicates significance at the .01 level for a one-tailed test. Critical *t* with 50 df = $\pm$ 2.40

TABLE FIVE

MEAN PERCENTAGES OF INTERPRETATION ACTIVITY (COGNITIVE LEVEL 3) IN NON-MODEL AND CONCEPT ATTAINMENT LESSONS

Cognitive Level 3 (%of all communications)	Teacher		Student	
	Questions	Statements	Questions	Statements
Non-Model Practice	3.20	.91	.05	2.96
Concept Attainment Practice	5.66	1.25	.07	5.33

Thus, when practicing the Concept-Attainment model, Middle Level Information-Processing increased to over 12% of all communications, which reflects the central purpose of the model. However, student-asked questions remained very low, indicating that student-involvement in the exploration of concepts, which should occur in Phase Three of the model, probably did not materialize in very many cases.

Group Investigation

Group Investigation is a democratic-process model built around cooperative problem solving. Because Group Investigation is much less directive than the other models, and requires a cooperative social system, it is in some ways the most complex to carry out. In addition it evolves slowly, requiring several interaction sessions at a minimum, while the others can be implemented more quickly. In Table Six the mean indices for Group Investigation practice sessions are compared with those for normal practice sessions.

Teacher talk dropped about 15 percent (Index One) and the "negotiated procedures" indices (Indices 2 and 3) both rose significantly. Students made contributions coded as "negotiating procedures" fifteen times more when candidates practiced Group Investigation than during non-model practice. In general, communication related to procedures increased in density while sanctioning and informational communications dropped accordingly.

TABLE SIX

COMPARISON OF MEANS OF NINE INDICES OF CLASSROOM INTERACTION FOR GROUP INVESTIGATION TEACHING AND NON-MODEL EPISODES

Index No.	Name	Mean for Gp. Inv.	Mean for Non-Model	S.D. Gp. Inv.	S.D. Non-Model	T
+1	Teacher Talk	0.536	0.638	0.080	0.053	-5.373*
+2	Negotiates Structuring Teacher	0.141	0.030	0.064	0.027	8.065*
+3	Negotiates Structuring Student	0.156	0.016	0.105	0.015	6.669*
4	Higher Level Information Processing	0.026	0.045	0.094	0.046	-0.930
5	Middle Level Information Processing	0.048	0.115	0.092	0.082	-2.727**
6	Positive Sanctioning	0.023	0.052	0.019	0.024	-4.622**
7	Negative Sanctioning	0.020	0.025	0.018	0.014	-0.992
8	Information Processing	0.315	0.590	0.165	0.085	-7.546**
+9	Procedural	0.429	0.186	0.152	0.071	7.337*

+ Model Relevant Index

**Indicates significance at the .01 level for a two-tailed test. Critical t with 50 df = $\pm$2.68

*Indicates significance at the .01 level for a one-tailed test. Critical t with 50 df = $\pm$ 2.40

Apparently the social characteristics of the model were actualized more than the intellectual characteristics, for the second and third phases should be characterized by much more Higher-Level Information Processing than is reflected in these data.

Summary: Did the patterns change?

In terms of the critical model-relevant indices, the bulk of the evidence points to the conclusion that teacher candidates did shift their patterns of verbal interaction with children in the directions specified by the models. Synectics is characterized by Higher-Level Information-Processing, especially at the synthesis level, and interaction at that level rose to many times the frequency in non-model teaching (See Appendix C). The negotiated structure characteristic of Group Investigation also appeared to rise substantially, although the theoretical information processing which should characterize it did not occur as much as was specified. When practicing Concept Attainment, teacher candidates and their students interacted at the conceptual (interpretation) level more than in non-model practice and to a lesser extent at the theoretical level.

Note: Ratings of Model Behaviors

Two side issues involve questions about successful model implementation, e.g., Efficiency Ratings. The first is whether some candidates were good "model learners" while others were not. The second is whether non-model behavior contributed to implementation of the model.

Ratings of the adequacy with which the teacher candidates carried out the models were made by trained observers (See Appendix D for the rating forms). The scores reflect the extent to which the general clinical behavior of the teacher approximated the specifications of each model. Table Seven provides the intercorrelation of these scores for the three models.

TABLE SEVEN

COEFFICIENT OF CORRELATION OF EFFICIENCY * RATINGS FOR THREE MODELS

		1	2	3
1	Group Investigation		.164	.266
2	Concept Attainment		____	.036
3	Synectics			____

No correlation even approached significance. Evidently performance performance in the practice of the three models was independent.

On the relationship between non-model behavior and model implementation, Table Eight provides the intercorrelations of indices of non-model teaching behavior and the efficiency scores for the three models.

* Indicates significance at the .05 level for a two-tailed test, critical r = $\pm$ .396 with 23 df.

TABLE EIGHT

COEFFICIENTS OF CORRELATION BETWEEN INDICES*
IN NON-MODEL PRACTICE AND EFFICIENCY SCORES
WHEN PRACTICING THREE MODELS

Index		Concept Assessment	Group Investigation	Synectics
1	Teacher Talk	.037	-.125	-.059
2	Negotiates Structuring Teacher	.269	.086	.348
3	Negotiates Structuring Student	.340	.076	-.348
4	Higher Level Information Processing	-.125	.005	.250
5	Middle Level Information Processing	-.029	-.259	.342
6	Positive Sanctioning	-.234	-.176	-.163
7	Negative Sanctioning	-.036	.006	-.122
8	Information Processing	.097	-.299	-.295
9	Procedural	.022	.249	.176

No correlation was significant. The most suggestive were coefficients between indices 4 and 5 and the Synectics score. However, it must be concluded that behavior in non-model practice was not related to the extent of implementation of the models.

* Indicates significance at the .05 level for a two-tailed test, critical r = $\pm$ .396 with 23 df.

Part III: The Cooperating Teacher and Model Practice

First, let us ask the question - were the indices of teacher candidates when not practicing the models related to the indices of the cooperating teachers, e.g., were their styles similar? In Table Nine coefficients of correlation of the indices are presented.

Table Nine

Coefficients of Correlation of Cooperating Teacher Indices and Non-Model Indices for Teacher Candidates

Index No.	Name	Correlation Coefficient
1	Teacher Talk	-.102
2	Negotiated Structuring-Teacher	.496*
3	Negotiated Structuring-Student	.608**
4	Higher Level Information Processing	-.234
5	Middle Level Information Processing	.341
6	Positive Sanctioning	.418*
7	Negative Sanctioning	.379
8	Information Processing	.358
9	Procedural	.399*

** Indicates significance at the .01 level for a two-tailed test. Critical r with 23 df=± .505

* Indicates significance at the .01 level for a one-tailed test. Critical r with 23 df=± .396

Four of the coefficients were significant and three others were above .34 although not significant. Only Teacher Talk and Higher Level Information Processing were so low as not to be suggestive. The structuring behavior indices (2,3,9) were all positive, with r for Negotiated Structuring, Student (Index 2) equalling .608. Positive sanctioning was also significantly correlated. This finding replicates the earlier study by Seperson and Joyce[20] which found procedural (structuring) behavior of teacher candidates to be associated with and influenced by cooperating teachers.

The second questions is: Were the model-relevant indices of the cooperating teachers related to the model-relevant indices of the teacher candidates as they practiced the models of teaching? In Table Ten coefficients of correlation are presented for the model-relevant indices.

Apparently the cooperating teacher style had little influence on the model relevant behaviors of the teacher candidates. There was some positive influence though not statistically significant on the Middle Level Information Processing and Concept Attainment In Group Investigation there was no positive relationship between the structuring with teacher candidates when practicing Group Investigation. Higher level communication (Index 4) by teachers apparently did not influence the implementation of Synectics (but, then, almost no cooperating teachers ever were coded while producing Higher Order question or statement);

TABLE TEN

Coefficients of Correlation Between Model-Relevant Indices

When Teacher Candidates Practiced the Models

and Indices of Cooperating Teachers

Cooperating Teacher Indices	Name	Concept Learning	Group Investigation	Synectics
1	Teacher Talk		-.088	
2	Negotiated Structuring-Teacher		.108	
3	Negotiated Structuring-Student		-.339	
4	Higher Level Information Processing	-.183		.067
5	Middle Level Information Processing	.348	.383	-.231
6	Positive Sanctioning	.308		.443*
7	Negative Sanctioning	.164		-.159
8	Information Processing		.139	

*Critical r with 23 df=$\pm$.396 for a two-tailed test at the .05 level

however, positive sanctioning was associated with that behavior when teacher candidates implemented Synectics.

The total pattern suggests that there was very little facilitating influence.

The last question again looks at the influence of the cooperating teacher's behavior on the implementation of the Models, this time on the Efficiency Scores.* The coefficients between the cooperating teacher indices and the efficiency scores of the teacher candidate for each model are presented in Table Eleven.

Except for the use of Middle Level Information Processing (Index 5) in Synectics (and the Concept Attainment coefficient is suggestive) there was no pattern of association. The negotiation which is characteristic of Group Investigation was rarely modelled by teachers and the influence is thus not likely to be discerned. Negative correlations in the sanctioning area are surprising- the models apparently pulled sanctioning behavior in many cases opposite to those being modelled in particular classrooms.

TABLE ELEVEN

Coefficients of Correlation of Model Relevant Indices of Cooperating Teachers and Efficiency Scores of Teacher Candidates When Practicing Models

Cooperating Teacher Indices	Name	Concept Attainment	Group Investigation	Synectics
1	Teacher Talk		.240	.365
2	Negotiated Structuring-Teacher		-.250	
3	Negotiated Structuring-Student		-.227	
4	Higher Level Information Processing	.072		.048
5	Middle Level Information Processing	.242		.451*
6	Positive Sanctioning	-.022		-.511**
7	Negative Sanctioning	-.466*		.192
8	Information Processing			
9	Procedural		-.162	

**Critical r with 23 df=$\pm$.505 for a two-tailed test at the .01 level

*Critical r with 23 df=$\pm$.396 for a two-tailed test at the .05 level

Part IV Practice of the Models in Primary and Intermediate Grades

In this section of the study the indices obtained during practice in the primary levels are compared with those obtained in the intermediate level. Eighteen teacher candidates practiced in grades K-2 and eight subjects chose grades 3-6. These placements were all in the public schools of New York City.

Table Twelve presents the comparison of mean indices computed for the two levels during "non-model" practice. Only for Index Five were the means significantly different; the proportion of Middle-Level communications was twice as high at the intermediate level. Otherwise, the indices were not significantly different.

In Table Thirteen the same comparisons are made for cooperating teachers in the same classrooms. Four of the means are significantly different. Communications pertaining to Procedures were twice as great at the primary level (Index 9) and Informational communications were fewer (Index 8). Negotiated procedural communications were proportionately higher in the primary level (indices 2 and 3). Middle Level communications (Index 5) were twice as high for older children.

Comparisons During Model Practice

Concept Attainment Model

Table Fourteen compares the indices as the Concept Attainment Model was practiced by teacher candidates. Indices 4 and 5, reflecting communications at the higher cognitive levels (the desired activity of the model), were both higher in the Intermediate Level.

TABLE TWELVE

T TEST OF NINE INDICES FOR NON-MODEL EPISODES OF TWENTY-SIX TEACHER CANDIDATES BASED ON GRADE LEVEL

		Grades K-2		Grades 3-6		
Index	Name	Mean	S.D.	Mean	S.D.	T
1	Teacher Talk	0.635	0.058	0.644	0.043	-0.404
2	Negotiates Structuring Teacher	0.035	0.028	0.018	0.024	1.492
3	Negotiates Structuring Student	0.018	0.016	0.010	0.012	1.291
4	Higher Level Information Processing	0.037	0.046	0.063	0.042	-1.382
5	Middle Level Information Processing	0.089	0.048	0.173	0.113	-2.679*
6	Positive Sanctioning	0.053	0.023	0.049	0.027	0.346
7	Negative Sanctioning	0.024	0.017	0.026	0.008	-0.348
8	Information Processing	0.577	0.075	0.621	0.102	-1.247
9	Procedural	0.204	0.061	0.145	0.079	2.058

*Indicates significance at the .05 level for a two-tailed test. Critical t with 24 df = $\pm$ 2.06.

TABLE THIRTEEN

T TEST OF NINE INDICES FOR FIFTEEN COOPERATING TEACHERS
BASED ON GRADE LEVEL

Index	Name	Grades K-2 Mean	Grades K-2 S.D.	Grades 3-6 Mean	Grades 3-6 S.D.	T
1	Teacher Talk	0.739	0.052	0.707	0.032	1.542
2	Negotiates Structuring Teacher	0.048	0.028	0.012	0.010	3.341**
3	Negotiates Structuring Student	0.023	0.020	0.004	0.003	2.553*
4	Higher Level Information Processing	0.013	0.022	0.011	0.009	0.171
5	Middle Level Information Processing	0.082	0.045	0.187	0.060	-4.946**
6	Positive Sanctioning	0.046	0.027	0.042	0.021	0.388
7	Negative Sanctioning	0.062	0.048	0.049	0.026	0.710
8	Information Processing	0.521	0.147	0.675	0.033	-2.888**
9	Procedural	0.260	0.109	0.137	0.033	3.076**

*Indicates significance at the .05 level for a two-tailed test. Critical t with 24 df = $\pm$ 2.06.

**Indicates significance at the .01 level for a two-tailed test. Critical t with 24 df = $\pm$ 2.80.

TABLE FOURTEEN

T TEST OF NINE INDICES FOR CONCEPT ATTAINMENT EPISODES FOR TWENTY-SIX TEACHER CANDIDATES BASED ON GRADE LEVEL

		Grades K-2		Grades 3-6		
Index	Name	Mean	S.D.	Mean	S.D.	T
1	Teacher Talk	0.635	0.049	0.639	0.035	-0.197
2	Negotiates Structuring Teacher	0.022	0.016	0.017	0.012	0.778
3	Negotiates Structuring Student	0.005	0.004	0.005	0.007	-0.290
+4	Higher Level Information Processing	0.064	0.029	0.098	0.047	-2.267*
+5	Middle Level Information Processing	0.167	0.066	0.240	0.056	-2.698*
6	Positive Sanctioning	0.055	0.025	0.044	0.019	1.055
7	Negative Sanctioning	0.019	0.013	0.029	0.015	-1.591
8	Information Processing	0.622	0.078	0.670	0.059	-1.537
9	Procedural	0.129	0.063	0.106	0.027	0.965

+ Model relevent index

*Indicates significance at the .05 level for a two-tailed test. Critical t with 24 df = $\pm$ 2.06.

Group Investigation Model

Table Fifteen compares the indices obtained during Group Investigation practice at the two levels. "Teacher Talk" was higher at the Primary Level (Index 1) as was negotiating behavior by teacher (Index 2) but not by students (Index 3). In this model the more characteristic behavior of less teacher talk occurred at the Intermediate Level. While teacher negotiating behavior was greater at the Primary Level.

Table Sixteen makes the same comparisons when Synectics was being practiced. The chief model-relevant index for Synectics is Index 4 and the difference favored the older children.

Summary

Thus, for two of the models, those designed to elicit higher-level information processing, the model-relevant index was higher in the intermediate grades, whereas for the other models some of the relevant indices favored the lower grades.

The overall picture is one of similarity, however. It seems reasonable to suppose that some models would be more easily implemented at one or another levels, but that will have to be explored in subsequent studies. The teacher candidates were able to practice the models at both levels but the differences in higher-order communication lead us to believe that applicability of models to children of different ages is not equal. Some models may be appropriate to children of one age and/or the process of implementation may be different (that is, teachers may require specific level-appropriate training).

TABLE FIFTEEN

T TEST OF NINE INDICES FOR GROUP INVESTIGATION EPISODES
OF TWENTY-SIX TEACHER CANDIDATES BASED ON GRADE LEVEL

		Grades K-2		Grades 3-6		
Index	Name	Mean	S.D.	Mean	S.D.	T
1	Teacher Talk	0.563	0.073	0.475	0.060	2.963**
2	Negotiates Structuring Teacher	0.161	0.062	0.094	0.042	2.748*
3	Negotiates Structuring Student	0.149	0.099	0.170	0.124	-0.453
4	Higher Level Information Processing	0.038	0.111	0.000	0.000	0.955
5	Middle Level Information Processing	0.032	0.058	0.084	0.141	-1.335
6	Positive Sanctioning	0.024	0.020	0.022	0.017	0.273
7	Negative Sanctioning	0.023	0.019	0.013	0.013	1.349
8	Information Processing	0.315	0.166	0.316	0.174	-0.002
9	Procedural	0.452	0.148	0.376	0.158	1.185

*Indicates significance at the .05 level for a two-tailed test. Critical t with 24 df = $\pm$ 2.06.

**Indicates significance at the .01 level for a two-tailed test. Critical t with 24 df = $\pm$ 2.80.

TABLE SIXTEEN

T TEST OF NINE INDICES FOR SYNECTICS EPISODES OF TWENTY-SIX TEACHER CANDIDATES BASED ON GRADE LEVEL

Index	Name	Grades K-2 Mean	Grades K-2 S.D.	Grades 3-6 Mean	Grades 3-6 S.D.	T
1	Teacher Talk	0.567	0.049	0.561	0.031	0.344
2	Negotiates Structuring Teacher	0.014	0.010	0.007	0.009	1.431
3	Negotiates Structuring Student	0.007	0.007	0.006	0.008	0.315
+ 4	Higher Level Information Processing	0.211	0.148	0.413	0.097	-3.504**
5	Middle Level Information Processing	0.205	0.070	0.155	0.099	1.452
6	Positive Sanctioning	0.029	0.019	0.039	0.036	-1.006
7	Negative Sanctioning	0.018	0.014	0.023	0.021	-0.679
8	Information Processing	0.605	0.103	0.558	0.191	0.819
9	Procedural	0.131	0.043	0.103	0.048	1.485

+ Model relevent index

**Indicates significance at the .01 level for a two-tailed test. Critical t with 24 df = ± 2.80

Part V: Personality and the Models of Teaching

It seems certain that personality influences teaching behavior, although precious few empirical studies have confirmed this.[20]

Four measures of personality and attitudinal orientation were taken of the 26 subjects in the study.* These are:

1. Conceptual Level (The Sentence Completion Test)[22]
2. The Allport/Vernon/Lindzey Study of Values,[23] which yields six scores, of which the social and theoretical orientations were especially interesting to us because they are theoretically related to the social and cognitive models.
3. Wehling/Charters Inventory of Teacher Conceptions of the Educative Process, which measures educational belief systems.[24] These sub-scores are pertinent to specific models: subject matter emphasis, personal adjustment ideology, and student autonomy.
4. The Kraitlow/Dreier Inventory - A Scale for Determining Teacher Beliefs[25] which yields these scores: Progressive (child-centered), community (socially-oriented), and academic (Subject-matter oriented.)

These measures were correlated with the model efficiency scores. The coefficients are presented in Table

* One student did not take the Study of Values test so the correlation matrix is for 25 students.

TABLE SEVENTEEN

COEFFICIENTS OF CORRELATION AMONG PERSONALITY MEASURES AND EFFICIENCY SCORES FOR ALL MODELS AND OVERALL MODEL PERFORMANCE

	Efficiency Scores			
Personality Measures	Concept Attain.	Group Inves.	Synectics	Overall
Conceptual Level	0.239	0.150	0.356	0.420*
Alport/ Vernon/Lindzey Theoretical	0.289	-0.271	0.230	0.177
Social	-0.041	0.611**	0.178	0.26
Wehling/ Charters: Subject Matter Emphasis	0.224	0.136	0.293	0.236
Personal Adjustment Ideology	-0.229	0.101	0.216	0.169
Student Autonomy	-0.153	0.062	-0.132	0.038
Kraitlow/Dreier Progressive	-0.067	-0.018	0.121	0.168
Community	-0.249	-0.174	-0.121	-0.165
Academic	-0.240	-0.016	-0.264	-0.152

*Indicates significance at the .05 level for a two-tailed test. Critical r with 23 df = $\pm$ .396.

**Indicates significance at the .01 level for a two-tailed test. Critical r with 23 df = $\pm$ .505.

Only two coefficients were statistically significant. One reflected the correlation between the social orientation from the Allport/Vernon/Lindzey Study of Values, and the Group Investigation efficiency scores. There was no other significant correlation between a specific model and a specific personality or attitude measure. Overall Model Efficiency was correlated with conceptual level (CL)(r=.420) which support the prediction one would make from conceptual systems theory - that conceptual flexibility would not facilitate any one model, but would be related to the overall ability to shift styles and carry out a range of models.

In general, then, personal characteristics were not related to performance in practicing the models, with the pattern of correlations being very low indeed.

Conceptual Level and Teaching Style

Because several previous investigations had indicated a relationship between conceptual level and teaching style,[25, 26] while several other studies had failed to replicate this[27, 28] coefficients of correlation were computed between the nine indices computed for Concept Attainment teaching and the estimates of conceptual level which were obtained from the sentences completion test. The results are presented in Table Eighteen.

TABLE EIGHTEEN

COEFFICIENTS OF CORRELATION BETWEEN CONCEPTUAL LEVEL SCORES AND NINE INDICES OF TEACHER-STUDENT INTERACTION

Index	Name	Conceptual Level Coefficient
1	Teacher Talk	-.094
2	Negotiates Structuring Teacher	.277
3	Negotiates Structuring Student	.207
4	Higher Level Information Processing	-.061
5	Middle Level Information Processing	-.005
6	Positive Sanctioning	-.217
7	Negative Sanctioning	-.372
8	Information Processing	.024
9	Procedural	.057

$r = \pm .396$ at the .05 level of significance for 23 d.f.

This finding (the lack of any significant correlation) fails to replicate the findings that conceptual level was related to several aspects of teaching behavior.

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APPENDIX A

PART I. Joyce System for Coding Student and Teacher Communications

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PART II. Teacher - Innovator System for Analyzing Skills and Strategies

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PART III. Consideration for Revision of the Teacher - Innovator System

PART I

The Joyce System for Coding Student and Teacher Communications (Joyce, et al, 1969) evolved from the Conceptual Systems Manual (cf, Appendix A in Joyce and Harootunian, The Structure of Teaching Chicago: Science Research Associates, 1967), and from Norris Sanders' Classroom Questions: What Kinds? (New York: Harper & Row, 1966). It consists of 59 categories of teacher and student behavior, divided into five broad classifications:

The application of sanctions

The development of structure

The handling of information

The maintenance of the class as a social system

The exchange of opinions

A unit of communication is defined as "one oral communication by a teacher or student on one topic and to one audience for a period of time not to exceed fifteen seconds." (The 1969-70 Manual)

The 59 categories are named and briefly described below.

A. Sanctioning. A communication should be classified as a sanction if, in the judgement of the observer, it's intended effect is to be rewarding or punishing to one or more persons. Teacher sanctions are classified by the type of behavior they are intended to reward or punish.

1. Rewarding lower cognitive processes. (S-1)* This category refers to rewarding communications applied to student behaviors at cognitive levels one and two (see below).
2. Punishing lower cognitive processes. (S-2)

*Refers to symbols used in coding.

APPENDIX A

Introduction

Appendix A consists of descriptions of the interaction analysis systems used to describe teacher-student behavior and analyze the implementation of the model. Part I presents the Joyce System for Coding Student and Teacher Communications. This was the system used for the present study. It has since been revised to better reflect our conception of skills and strategies (See Part II The Teacher-Innovator System for Analyzing Skills and Strategies). Finally, Part III looks at directions for further revision.

In a sense the development of the Models of Teaching work can be followed in the revisions of the interaction analysis schemes.

JOYCE SYSTEM FOR CODING
STUDENT AND TEACHER COMMUNICATIONS

I. SANCTIONS

	Teacher					Student
	Lower Mental Processes	Higher Mental Processes	Group Relations	Rules and Directions	General	
positive	S1	S3	S5	S7	S9	S11
negative	S2	S4	S6	S8	S10	S12

II. INFORMATION PROCESSING

	Cognitive Levels						
Speaker	Memory	Translation	Interpretation	Application	Analysis	Synthesis	Evaluation
Teacher Question	TQ1	TQ2	TQ3	TQ4	TQ5	TQ6	TQ7
Statement	TS1	TS2	TS3	TS4	TS5	TS6	TS7
Student Question	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6	SQ7
Statement	SS1	SS2	SS3	SS4	SS5	SS6	SS7

III. OPINIONS

Teacher		Student	
Asks	Gives	Asks	Gives
01	02	03	04

IV. STRUCTURING

Procedures				Standards			
Directive		Cooperative		Directive		Cooperative	
Teacher	Student	Teacher	Student	Teacher	Student	Teacher	Student
P1	P2	P3	P4	P5	P6	P7	P8

V. MAINTENANCE

Transition		Small Talk		Routine		Repeat
Teacher	Student	Teacher	Student	Teacher	Student	Teacher
M1	M2	M3	M4	M5	M6	59

3. Rewarding higher cognitive processes. (S-3) This category refers to communications which reward student behaviors at cognitive levels three through seven.

4. Punishing higher cognitive processes. (S-4)

5. Sanctioning group relations. The behavior being rewarded (S-5) or punished (S-6) is the student's relations with others in the classroom.

6. Sanctioning the ability to obey directions or rules. The behavior being rewarded (S-7) or punished (S-8) is the student's ability to conform to procedures whether developed by the teacher or formulated through student interaction.

7. Offering general support. (S-9) This remark denotes general approval, appreciation, or encouragement.

8. Offering a general unsupportive statement. (S-10)

9. Student rewards behavior. (S-11)

10. Student punishes behavior. (S-12) Both of these categories describe student sanction directed to anyone else on any type of behavior.

B. The handling of information. The seven cognitive levels are taken from Norris Sanders and closely follow his definitions. Each level may be coded as teacher question or solicitation (TQ), teacher statement (TS), student question or solicitation (SQ), and student statement (SS). Each classification is based on inferences about the kind of thinking which is intended through interaction at that level.

1. Memory. (TQ1, TS1, SQ1, SS1). The presentation or solicitation of information such that only the operation of recall or recognition are called for. The assumption is that data is not transformed in any way at this level.

2. Translation. (TQ2, TS2, SQ2, SS2) The changing of words or ideas in a communication into parallel forms of communication; for example, written to oral or iconic to symbolic (picture to word). Translation is quite literal.

3. Interpretation. (TQ3, TS3, SQ3, SS3). This operating cognitively on given information by 1) explaining or summarizing, or 2) by determining relationships of implication, consequence, comparison and contrast, cause and effect, or inductive generalization drawn from supporting evidence.

4. Application. (TQ4, TS4, SQ4, SS4) This is the application of abstractions to particular and concrete (real life) situations.

5. Analysis. (TQ5, TS5, SQ5, SS5) The breakdown or explanation of information into its constituent ideas so that the relative hierarchy and the relations between the ideas are made explicit. Much of analysis involves applying the rules of logic, that is, working with a consciousness of the parts and processes of reasoning.

6. Synthesis. (TQ6, TS6, SQ6, SS6) This is the creative selection and combination of discrete elements or parts of an individual's knowledge into a whole which is a new or unique pattern or structure in terms of the learner's previous thinking.

7. Evaluation. (TQ7, TS7, SQ7, SS7) The development of standards or values as criteria for creative problem-solving or judgment of value, and the application of these criteria.

C. Opinions. An evaluative statement which is not grounded in externally derived criteria.

1. The teacher asks for an opinion (O-1)

2. The teacher gives an opinion (O-2)

3. The student asks for an opinion (O-3)

4. The student gives an opinion (O-4)

D. Structuring communications. These are communications which function either to develop procedures for organizing and carrying out activities in the classroom or to develop standards of performance.

1. Directive procedures. Assertions by teachers (P-1) and students (P-2) about procedures which are either imposed on someone or justified by an appeal to authority or custom.

2. Cooperative procedures. Teacher (P-3) and student (P-4) communications which invite others to participate in developing procedures.

3. Directively determing standards of performance. Communications by teacher (P-5) or students (P-6) establishing the criteria by which the adequacy of a performance or activity is judged, imposed upon the person(s) to whom it applies, even though it may be diplomatically or respectfully imposed.

4. Cooperatively determining standards of performance. Teacher (P-7) and student (P-8) communications which attempt to share in the determination of standard of performance.

E. Maintenance. These are the categories of communication which function to maintain the social system among students and teacher, as well as the physical and administrative ecology of the school as an institution.

1. Providing a Transition. These are communications by teacher (M-1) or student (M-2) during a formal interchange with another member of the classroom which serve to maintain control over a break in substance, whether it is killing time deliberately refraining from comment ("Well. . .") or signalling a shift from one line of thought to another.

2. Making small talk. The teacher (M-3) or student (M-4) talks about topics that are personal in nature and not directly related to the business of the school, although the communication may effect rapport with another.

3. Discussing routine. Teachers (M-5) and students (M-6) talking about routine organizational matters not directly related to instruction.

4. Repeat. (59) The teacher repeats student communication.

A-7

Part II

The Teacher-Innovator System for Analyzing Skills and Strategies (Joyce, Gullion, Weil, et al, 1971) is designed to have two functions as a classroom observation tool. First, it was conceptualized using the framework and language of the three teaching skills (Joyce, Weil and Wald, 1972) and the Models of Teaching (Joyce & Weil, 1972) which are part of the operationalization of the Teacher-Innovator (Joyce, 1968) model of teacher education, and is thus a particularly appropriate instrument for describing the use of these skills and strategies by both preservice and inservice teachers. Second, the designers of the system took into account the practical experience and needs of preservice supervisors and students who are studying the development and character of teaching styles in general; thus the System is valuable as a general descripter and analyzer of teacher behavior as well. The System is divided into three major sections: Structuring, Information Processing, and Feedback, and a fourth section, Digression, which is used to code communications of all types which diverge from the substantive focus at hand. A fifth section consists of Subscripts, which describe the instructional function of the communications in the first 13 categories in greater detail.

In developing the System, we recognized that the classroom interaction of teachers and students (like that of all people) is complex, and that we cannot in all honesty create a set of categories which are all mutually exclusive. We sought instead to develop a system which sets priorities in terms of the information about a teaching style we considered most valuable for description and diagnosis within the framework of Skills and Strategies. For example, we chose to describe in detail behaviors which fell within the general focus of

I. STRUCTURING

A. Planning

Goals and Standards		Context		Procedures	
Directive	Negotiated	Directive	Negotiated	Directive	Negotiated
1	2	3	4	5	6

B. Implementation

Instructional	non-Instructional
7	8

Subscripts*

1. data	6. summarizing
2. cuing	7. reflecting
3. redirecting	8. integrating
4. clarifying	9. non-verbal
5. justifying	

II. INFORMATION

Level 1	Level 2	Level 3	Open	Opinion
9	10	11	12	13

III. FEEDBACK

Positive	Neutral	Negative	Corrective	Repeat	Digression
14	15	16	17	18	19

* May be used with Information Processing (9 - 13) or Structuring (1 - 8).

a lesson, rather than everything that happened in order (among other things) to highlight the use of a strategy (hence the catch-all category, digression). In other words, we sought to describe teaching in terms of empirical and intuitive sense of those moves (some formally logical, some instructionally functional. which seemed central to the teaching act (cf, B. Paul Komisar, "Teaching: Act and Enterprise," in C. J. B. Macmillan and Thomas W. Nelson, Ed., Concepts of Teaching: Philosophical Essays, 1969). We have learned, through experience, where we need to clarify our concept and where we have tried to be too economical, and Part III of this Appendix looks at possible directions for revision. Part I presented the Joyce System for Coding Student and Teacher Communications, which is the major source in the development of the present system.

The structure of each section of the Teacher-Innovator System is presented in the icon on page 2, and brief definitions of each category are given below:

I. Structuring.

Structuring communications set and maintain the general framework within which a classroom activity takes place.

A. Planning. These are moves which plan a classroom activity prior to its occurrence. The teacher may make all of the decisions (directive planning), or she may negotiate with students on any or all of the aspects of planning (negotiated planning).

1. Goals and Standards. These communications set the expected outcomes of a classroom activity, such as the product, the behavioral objective, the standard of achievement or proficiency, and the criteria which will be used to evaluate outcomes. May be either directive (1)* or negotiated (2).

2. Content. These communications set the context of the lesson within the ongoing work of the class, in terms of prior and future instructional activities, and determine the substantive focus of the activity being structured. May be either directive (3) or negotiated (4).

3. Procedures. These moves set the details "who and "how." For example, dividing a class into teams for a spelling bee, giving directions for a worksheet exercise, describing the procedure in a concept attainment game are all procedural planning moves. Included in this category are the negotiations, which may go on at some length, when students are given the opportunity of deciding how they want to go about studying a given content area. May be either directive (5) or negotiated (6).

B. Implementation. These moves direct non-verbal, non-Information Processing student behaviors while a classroom activity is going on. They are distinguished from Planning moves by the immediacy of the response expected. For example, a teacher who says "After you've finished your math, line up at the door," is planning. One who says "Line up at the door," is implementing.

*Refers to category number (1-19)

1. Instructional implementation moves (7) are directives which control the use of instructional materials ("Open your books") or the behavior of students for purely instructional purposes (" Now look at this chart"). It does not include those instructional directives which call for cognitive activity, such as the use of manipulatives in math, the drawing of a graph, writing a poem, or classifying data non-verbally, through the use of symbols drawn on the blackboard (stars, triangles, etc.). These are coded as Information Processing at the appropriate levels.
2. Non-instructional implementation moves (8) are directives which focus on the social environment of the classroom, by enforcing the norms or rules for group and individual behavior, ("Sit down and be quiet, please." "Get in line."), and maintain the classroom as a physical environment ("Would you clean the blackboards, Peggy?" "Open the window.")

II. Information Processing. Information processing communications generate and manipulate data through interactive teaching, either verbally or non-verbally. Data is used here to include all kinds of information related to a substantive focus, from facts to concepts to theories to opinions and feelings. Distinguish Information Processing from the use of data in Planning as the difference between using it as an object, and focusing on it as the subject of interaction .

A. Cognitive Levels.

1. The Factual level (9). The cognitive processes at this level are recalling, identifying, enumerating, describing, and translating

information from one medium or mode to another (e.g., written to spoken, iconic to symbolic). The assumption is that data is not manipulated, interrelated or transformed in any substantial way at this level, but is given or used as given.

2. The Conceptual level (10). Cognitive processes at this level are those which interrelate pieces of data in order (for example) to compare and/or contrast, to draw cause-effect inferences, to interpret data (what the shape of a curve means, what setting an author's description brings to mind), to apply givens or general knowledge to a problem-solving situation, and to form concepts.
3. The Theoretical level (11). This is the level at which concepts and facts are generalized into a larger theoretical structure, and at which problems are creatively or synthetically solved. Other cognitive activities at this level include hypothesizing, developing criteria and making judgments of value ("good," or "bad," "important" or "trivial," e.g., in literature, political policy, ethics), and the creative process (e.g., writing original poetry, composing a piece of music, designing an experimental study).

B. Other Categories.

1. Open. This category is used to code questions or statements whose source or intent in terms of cognitive processes cannot be determined. Included in this category are those questions which are phrased so generally that they do not define adequately what kind of information the teacher is seeking ("Can you tell me anything about..."), and those statements which are muddled, incomplete or so oblique that cognitive level cannot be determined.

A-15

2. Opinion (13). Statements or questions which express personal opinions or personal prejudices (i.e., judgments whose source and justification are personal or subjective rather than objectively or empirically derived related to the substantive focus of a classroom activity are coded as Opinions. Should a lesson focus on experience-based content, the interaction is coded as Information Processing at the appropriate levels.

III. Feedback moves react (to use Arno Bellack's term*) to instructional and non-instructional behaviors in the classroom and thus set the affective quality of the class (positive/negative), serve as "road signs" to the individual, letting him know where he stands, and verbally evaluate his behavior or intellectual performance.

1. Positive. (14) This category indicates that a verbal or non-verbal behavior is acceptable, appropriate or correct and may also comment on the degree of correctness, etc.

2. Neutral. (15) This is used to code those short, relatively non-committal reactions (frequently unconscious or habitual) which indicate more that the communication was heard and understood than anything else. Examples are "um hmm," "yeah," "okay." May be mildly positive in tone, but also may be used when the speaker wishes to make a response but withhold any evaluative comment at that point.

3. Negative. (16) The opposite of positive feedback, indicating the incorrectness, unacceptability or inappropriateness of a behavior.

4. Corrective Feedback. (17) Describes a qualified response to another's behavior (for example "almost..." or "Yes, but...") or moves directively to correct a mistake by providing the right response, or

* Arno Bellack, et al, The Language of the Classroom

codes a student's "I don't know" as feedback to a teacher that he or she is moving into unfamiliar substance.

5. Repeat. (18) Used to code repetition of another's communication. For example, a teacher sometimes repeats a correct answer, in effect underlining it, or she may habitually and indiscriminately repeat almost everything students say. Students on their part may repeat a teacher's communication (such as a correction of pronunciation).

IV. Digression. This is used to code interactions which stray from the substantive focus of a lesson and from the instructional or non-instructional planning and implementation which keep a class organized and moving through classroom activities. Interruptions of a lesson by an outside party or by an unforeseeable event (fire drill, for example) should be noted as an interruption, and coding resumed when it ends.

V. Subscripts. There are nine subscripts which are used to describe the sequences of instructional and/or logical moves which teachers and students make in order to establish and maintain discourse within the teaching/learning enterprise. This classification is the most directly connected with studying the functional dynamics of classroom interaction.

1. Data. This is an instructional move which describes straightforward generation of information, regardless of the cognitive level, or type of Structuring involved. This is the most common subscript used and should be used if it is clear none of the other subscripts apply.

2. Cuing. These communications pull a student toward an expected response by asking leading questions or giving hints. The object is to maximize the student's chance for making an acceptable contribution.

3. Redirecting. These are very brief instructional moves which implicitly ask the same question again, such as "Anything else?" or "John?"

4. Clarification. These moves seek to bridge a semantic gap in order to facilitate communication. They may be instructional (for example, "What? I didn't hear you.") or logical ("What? I don't understand you."—which asks for definition of terms or clearer restatement of an unclear communication) in nature.

5. Justify. These are logical moves which seek or give criteria or evidence to support a previous data input.

6. Summarizing. These are instructional moves which serve generally to close a phase or cycle of instruction or to facilitate continued interaction by verbalizing what has been said or done so far.

7. Reflecting moves are an integrative discussion skill. They pull the interactors into a mutual consideration of process, i.e., what has just been said or done, and, in effect, raise the consciousness of all involved of what has happened and where they stand.

8. Integrating moves integrate disparate facets of thought or conversation and/or pull the discussants toward or away from a particular aspect of the substance of a lesson.

9. Non-verbal Used to code cognitive activity which is not verbalized but which is the focus of interaction, such as using manipulatives in math or drawing an illustrative diagram on the blackboard.

VI. Coding units and symbols

Taba and Elzey's definition of a "thought unit" is heuristic in defining coding units:

> "thought unit" was defined as a remark or series of remarks expressing a more or less complete idea, serving a specific function, and classifiable according to a level of thought.*

In this system, a "coding unit" is defined as a verbal or non-verbal move expressing a generally complete idea, serving a single function (as defined by the 19 categories above), spoken by a single speaker to a single receptor. Every change of "idea," function, and/or speaker calls for a new coding entry.

Communications are coded as teacher question or solicitation (TQ), teacher statement or gift (TS), student question or solicitation (SQ), and student statement or gift (SS), plus the appropriate category number (e.g. teacher statement directively structuring content, TS3, student asking factual level question, SQ9), and subscript if appropriate.

Note that the subscripting categories 1 - 9 may be used with both Structuring and Information Processing moves (categories 1 - 13). A subscript is indicated by the addition of any number .1 through .9 after the category number (e.g. teacher redirecting a factual level question, TQ9.3, student justifying a negotiated procedural suggestion, SS6.5).

*Teaching Strategies and Thought Process," by Hilda Taba and Freeman F. Elzey, reprinted in Ronald Hyman, ed., Teaching: Vantage Points for Study, Philadelphia: J.B. Lippincott, 1968, p.447.

PART III: CONSIDERATIONS FOR REVISION OF THE TEACHER-INNOVATOR SYSTEM FOR ANALYZING SKILLS AND STRATEGIES

Our experience with the Teacher-Innovator System leads us to consider a number of possible revisions for the sake of greater conceptual cc istency and descriptive strength. The directions which such revisions might take are suggested below; they reflect some of our current concerns in the study of teaching.

I. We feel a need for a more satisfactory way to classify interaction the substance of which is personal experience or personal feeling (such as that elicited in the Role-Playing Model), which would distinguish between personally and externally derived data and describe each in terms of cognitive and instructional functions.

II. The Subscripts could be conceptualized more consistently as parallel sets of instructional and logical moves, with the latter more closely tied to the cognitive levels. A careful analysis of the information provided by each kind of Subscript is a move toward organizing the data provided by the System into sequences or cycles of behavior (akin to the Bellackian cycles), which would add a dimension to our understanding of the dynamics of "the language game ," particularly as it exists within a Model environment.

III. While Focusing is viewed as one of the three fundamental teaching skills connected with use of the Models of Teaching, the System does not describe establishment, maintenance, or shifts of focus, beyond the record of shifts from interaction over the general focus to interaction which strays from it (Digressions). One possible approach to Focusing is to create a classification which describes shifts from interaction focusing on substance to interaction Focusing on process, whether it is cognitive (as in the Concept Learning Model), or group interaction (as in the Group Investigation Mbdel).

APPENDIX B: COMPUTATION OF INDICES

Index One. TEACHER TALK

S1 + S2,+ S3 + S4 + S5 + S6 + S7 + S8 + S9 + S10 + TQ1 + TQ2 + TQ3 + TQ4 + TQ5 + TQ6,TQ7 + TS1,+ TS2 + TS3 + TS4 + TS5 + TS6 + TS7 + O1 + O2 + P1 + P3 + P5 + P7 + M1 + M3 + M5 + 59/All Communications

Index Two: NEGOTIATED STRUCTURING TEACHER

P3/ All Communications

Index Three NEGOTIATED STRUCTURING, STUDENT

P4/ All Communications

Index Four HIGHER LEVEL INFORMATION PROCESSING

TQ4-6 + TS4-6 + SQ4-6 + SS4-6*/All Information Processing Communications

Index Five MIDDLE LEVEL INFORMATION PROCESSING

TQ3 + TS3 + SQ3 + SS3*/All Information Processing Communications

Index Six POSITIVE SANCTIONING

S1 + S3 + S5 + S7 + S9/All Communications

Index Seven NEGATIVE SANCTIONING

S2 + S4 + S6 + S8 + S10/All Communications

Index Eight INFORMATION PROCESSING

TQ1 + TQ2 + TQ3 + TQ4 + TQ5 + TQ6 + TQ7 + TS1 + TS2 + TS3 + TS4 + TS5 + TS6 + TS7 + SQ1 + SQ2 + SQ3 + SQ4 + SQ5 + SQ6 + SQ7 + SS1 + SS2 + SS3 + SS4 + SS5 + SS6 + SS7/All Communications

Index Nine PROCEDURAL

P1 + P2 + P3 + P4 + P5 + P6 + P7 + P8/All Communications

*Provided that at least one communication from both teacher and student occurred at each level.

APPENDIX C

MEAN PERCENTAGES OF SUB-CATEGORIES IN NON-MODEL AND MODEL LESSONS OF TEACHER CANDIDATES AND TEACHING BEHAVIORS OF COOPERATIVE TEACHERS

Category	Mean % Non-Model	Concept Attainment	Group Investigation	Synectics	Cooperating Teachers
General Category-Sanctioning:					
T rewards lower mental activity	3.82	3.37	1.11	1.62	3.19
T punishes lower mental activity	0.71	0.38	0.13	0.24	1.05
T rewards higher mental activity	0.88	1.47	0.23	1.35	0.73
T punishes higher mental activity	0.11	0.27	0.02	0.10	0.22
T rewards group relations	0.03	0.03	0.00	0.00	0.03
T punishes group relations	0.13	0.06	0.07	0.05	0.13
T rewards following directions	0.09	0.07	0.36	0.08	0.20
T punishes following directions	1.48	1.49	1.66	1.63	3.68
T generally supportive	0.44	0.31	0.74	0.28	0.60
T generally punishing	0.13	0.14	0.21	0.08	0.41
S rewards	0.05	0.02	0.23	0.05	0.03
S punishes	0.97	0.58	1.33	1.09	0.37
General Category-Information:					
T question memory level	8.81	5.79	5.15	5.66	9.52
T statement memory level	7.27	5.66	5.60	4.96	10.12
S question memory level	0.85	0.44	0.94	0.47	0.81
S statement memory level	12.07	6.90	10.26	11.21	11.42
T question translation level	6.35	10.68	1.02	2.48	5.12
T statement translation level	3.88	3.03	2.19	2.26	6.87
S question translation level	0.37	0.16	0.33	0.35	0.15
S statement translation level	9.71	14.00	3.41	5.37	7.29
T question interpretation level	3.20	5.66	1.26	5.04	3.18
T statement interpretation level	0.91	1.25	0.17	1.25	0.72
S question interpretation level	0.05	0.07	0.02	0.02	0.22
S statement interpretation level	2.96	5.33	0.89	5.48	2.86
T question application level	0.68	1.11	0.13	0.92	0.49
T statement application level	0.09	0.12	0.02	0.05	0.01
S question application level	0.00	0.00	0.00	0.00	0.02
S statement application level	0.61	1.33	0.04	1.32	0.36
T question analysis level	0.33	1.08	0.12	0.55	0.05
T statement analysis level	0.13	0.24	0.00	0.08	0.06
S question analysis level	0.01	0.01	0.00	0.00	0.00
S statement analysis level	0.25	0.90	0.10	0.55	0.06

MEAN PERCENTAGES OF SUB-CATEGORIES IN NON-MODEL AND MODEL LESSONS OF TEACHER CANDIDATES AND TEACHING BEHAVIORS OF COOPERATIVE TEACHERS

Category	Mean % Non-Model	Concept Attainment	Group Investigation	Synectics	Cooperating Teachers
T question synthesis level	0.21	0.02	0.01	5.82	0.02
T statement synthesis level	0.02	0.02	0.00	0.47	0.00
S question synthesis level	0.00	0.00	0.00	0.02	0.00
S statement synthesis level	0.25	0.02	0.00	5.64	0.01
T question evaluation level	0.11	0.01	0.00	0.00	0.00
T statement evaluation level	0.00	0.00	0.00	0.00	0.00
S question evaluation level	0.00	0.00	0.00	0.00	0.00
S statement evalution level	0.02	0.00	0.00	0.02	0.00
General Category-Opinioning:					
T asks for opinion	0.81	1.36	2.90	3.30	0.36
T gives opinion	0.26	0.43	0.80	0.43	0.18
S asks for opinion	0.01	0.08	0.23	0.08	0.02
S gives opinion	1.65	2.10	5.43	6.15	0.37
General Category-Procedures:					
T directs procedures	11.65	8.22	9.27	8.37	14.56
S directs procedures	2.18	1.21	2.83	1.54	0.77
T negotiates procedures	3.05	2.19	14.17	1.33	3.22
S negotiates procedures	1.65	0.60	15.66	0.80	1.56
T directs standards	0.04	0.03	0.12	0.04	0.02
S directs standards	0.03	0.01	0.32	0.00	0.01
T negotiates standards	0.05	0.02	0.38	0.26	0.04
S negotiates standards	0.05	0.00	0.20	0.23	0.03
General Category- Maintenance:					
T provides transition	3.79	3.90	3.07	3.71	3.36
S provides transition	0.05	0.06	0.12	0.07	0.00
T makes small talk	0.43	0.48	0.40	0.32	0.31
S makes small talk	2.32	2.41	3.76	3.45	1.47
T discusses routine	0.07	0.13	0.13	0.01	0.35
S discusses routine	0.03	0.06	0.19	0.01	0.09
T repeat by teacher	3.89	4.72	2.27	4.64	3.50

Appendix D: Rating Forms

The rating scales used to obtain Model Efficiency Scores on the following pages. The scales are based on the Interaction Analyses System (see page A-1). Points are given for the presence in a given model lesson or lesson sequence of the model relevant interaction categories or category sequences indicated on the form. The higher the point score the more fully was the model syntax and environment manifested.

The items on the rating scale are interaction analyses extrapolations of verbal descriptions of the Model Syntax, Social System and Principles of Reaction. Subsequent Models of Teaching Research (1971-72) uses Scores based on Clinical Assessment rather than Interaction Analysis data, (See the Performance Guide and Evaluation for Group Investigation). In this way prototype model interaction patterns can be derived empirically by correlation with the Clinical Measures. Also, the relative effectiveness of the two types of assessment can be compared. Still a third rationale for the Clinical Measure is its advantages as a supervisory feedback tool.

EFFICIENCY SCALE: CONCEPT ATTAINMENT MODEL

Points	Description
0	Did not do the Model. Absence of Cognitive Level 3, indicating interpretation not present. OR Deductive Model indicated by high cognitive level processing at initiation of interaction.
1	Examination of Exemplars. More than ten communications at Cognitive Levels 1 and/or 2.
1	Memory and/or translation plus Interpretation. Cognitive Levels 1 and/or 2 plus Cognitive Level 3.
1	Application. Cognitive Level 4.
1	Analysis. Cognitive Level 5.
1	Sequence. Cognitive Levels 1 and/or 2, plus 3, plus 4, plus 5, or
2	Sequence. Cognitive Levels 1 and/or 2, plus, 3 plus 5, plus 4.
1	Extensiveness of Information Processing. Add one to either of above sequence if Levels 3, 4 and 5 each has minimum of one teacher communication plus three student communications. Student communications need not be consecutive.
2	Sanction. No more than one negative sanction of any cognitive processing, that is one or less S2, and one or less S4.
10	Maximum Possible Points

EFFICIENCY SCALE: GROUP INVESTIGATION MODEL

Points	Description
0	Did not do the model. No P3's or P'4 present, indicating absence of verbal interaction over negotiated procedures.
1	Presence of Negotiated Procedures. P3's, P4's present.
2	Sequence. Presence of following three student communications in sequence, P3, P4, P4, P4. Sequence must be present at least twice.
1	Standards. Presence of P5, P6, P7, P8. One or all of them present in any combination indicating interactive communications regarding the setting of standards, either directed or negotiated.
2	Negotiated Standards. P7, P8 (P5, P6 cannot be present). Indicates discussion over objectives and standards that is negotiated.
2	Student Talk. More student talk than teacher talk.
1	Negative Sanctions. Two or less negative sanctions by teacher following any procedural communication by student.
9	Maximum Possible Points

EFFICIENCY SCALE: SYNECTICS MODEL

Points	Description
0	Did not do the Model. Cognitive Levels 3 or 4 or 5 or 6 not present indicating no interpretation, application, analysis, or synthesis.
1, 2, or 3	Lower Information Processing One point for presence of each of the cognitive levels 3, 4, 5, or 6. Maximum points 3.
1	Negative Sanctions: Higher Cognitive Level. Two or less negative sanctions S4, for higher cognitive functioning.
1	Negotiated Procedures P3's, P4's indicates students' decision making regarding choice of analogies.
1	Directive Structuring. Presence of P1 indicates students' decision making regarding choice of analogies.
2	Student Talk. More student talk than teacher talk.
1	Description. Cognitive levels 1 and/or 2. Indicates communications describing present condition or substantive in-put.
9	Maximum Possible Points

PERFORMANCE GUIDE AND EVALUATION:

GROUP INVESTIGATION (PHASES ONE AND TWO)

Name_____ Subject Area_____

Date (Week No.)_____ Supervisor (Rater)_____

Grade_____ Task Type 06_____

Size of Group_____

Topic or Description of Confronting Incident:

Instructions:

Attached is the clinical assessment form for evaluating the interactive sessions over Phase One and Two of the Group Investigation Model. (Teacher-candidates are being asked to develop Phases One and Two for two Group Investigation Models, one of which will be carried through to completion and written up by the teacher-candidate in a log). Phase One and Two may take more than one session. You should be present for all interactive sessions concerned with these phases of the model. Turn in one of these forms for each model.

The Performance Guide items are based on the key elements discussed in the Training Models. The pertinent key element is indicated beside each item (S - Model syntax, P - problem focus, I - inquiry, GP - group process and TR - teacher role) and the score line for that item is placed in the appropriate column. Thus, subscores may be obtained for each element.

Scoring:

Circle the appropriate response for each item. Score one point for each yes and zero points for each no. Scoring of responses to questions not answered by yes or no is indicated below the responses. Record the score for each item in the appropriate line and column. Sub Total the score for each column as indicated and then add these together for a total score.

SCORE

(S)yntax	(P)roblem	(I)nquiry	(G)roup (P)rocess	(T)eacher's (R)ole

Phase One: Encounter and Reaction

1) The Puzzling Situation

*a) Critical Incident: Was there a puzzling situation in which there was a problem to be solved, an issue to react to, or an activity to undertake? (S)

Yes No

Problem Issue Activity

b) Structure: Did the puzzling situation orient the students to a possible task (e.g. to provide an explanation, obtain information, problem-solving, predicting hypothesis testing, completing an activity) either by the choice of the data presented or by the teacher's giving instructions and asking questions which focus on possible kinds of activities OR was the problem-focus (task) to be entirely emergent? (P)

Specified (1) Emergent (0)

c) Emotional Involvement: Were the students involved by the problem or puzzling situation (e.g. did it grab them)? (I)

Yes No

d) Problem: Did a problem exist for the students (e.g. did they have to obtain additional information to solve it or put previously acquired behaviors together in new ways?

Yes No

Phase One: Encounter and Reaction (cont.)

e) Appropriateness: Did the students have the necessary experiential or knowledge background to respond to the problem? (P)

Yes No

2) Reaction and Discussion

*a) Diversity: Was there a diversity of reactions? (S)

Yes No

*b) Exploration: Were the various reactions discussed, compared and the diversities made explicit? (S)

Yes No

c) Interaction: Did students respond to and build upon each others ideas? (GP)

Yes No

d) Teacher Role: Were student reactions directed toward the teacher or towards each other (e.g. what role did the teacher play in the discussion)? (TR)

Leader (dominant participant) (0) | Clarifier/ Reflector (1) | None (0)

3) Formulation of Problem-Focus or Task

*a) Problem Focus: Was a problem focus or task identified? (s)

Yes No

SCORE

(S)yntax	(P)roblem	(I)nquiry	(G)roup (P)rocess	(T)eacher's (R)ole
	—			
—				
—				
			—	
				—
—				

Phase One: Encounter and Reaction (cont.)

b) Inquiry: Who was the source of the problem focus, the teacher or the students? (GP) (I)

b) Inquiry: Who was the source of the problem focus, the teacher or the students? (GP) (I)

Teacher (0) Students (1)

c) Inquiry: Was the problem-focus or the selection process oriented towards inquiry (e.g. did it involve questions and statements that call for explanation of data, predictions, propositions or hypotheses or problem solutions)?

Yes No (I)

d) Involvement: Did the students generate and discuss several alternatives?

Yes No (GP)

Phase Two: Planning/Organization of Inquiry

1) Further Analysis

*a) Was there further discussion about the nature of the problem (e.g. definition of terms)?

Yes No (S)

*2) Breakdown of Task

a) Task Breakdown: Was the task or problem focus broken down into a set or sequence of activities?

Yes No (S)

SCORE

(S)yntax	(P)roblem	(I)nquiry	(G)roup (P)rocess	(T)eacher's (R)ole
		____	____	
		____		
			____	
____				
____				

Phase Two: Planning/Organization of Inquiry (cont.)		SCORE				
		(S)yntax	(P)roblem	(I)nquiry	(G)roup (P)rocess	(T)eacher (R)ole
b) Task Mutuality: Did the problem-focus or task require cooperative efforts for its solution (e.g. are the task activities interdependent and essential to successful completion of the effort)?						
Yes No	(P)		———			
3) Role Analysis and Assignment						
*a) Roles: Was there an analysis and assignment roles?						
Yes No	(S)	———				
b) Roles: Did the role assignments grow out of group decision making based on the task requirements, independent choices by individuals, or from the teacher?	(GP)				———	
Group (1) Individual (0) Teacher (0)						
4) Teacher Role						
a) Autonomy: What role did the teacher have in planning?	(TR) (GP)				———	———
Leader (0) Reflector/Clarifier (1) Not Present (0 or 1 if appropriate)						
SUBTOTAL (each element)						
TOTAL (all columns)						

APPENDIX E

SUPPLEMENTARY ANALYSIS:
THE DETERMINATION OF MODEL ENVIRONMENTS
USING ANALYSIS OF VARIANCE

If we think of Models of teaching as creating distinct learning environments, one important question to ask with respect to this study is whether the environments were different. In other words, were there greater variations in the nine environment indices among the four environments than within a model environment, the four environments being Concept Attainment, Group Investigation, Synectics and Non-Model? For each index, a one way analysis of variance with repeated measures was computed for each of the twenty-six subjects in each of the four conditions of teaching. The results can be found on Table 20.

TABLE TWENTY

SUMMARY DATA AND ANALYSIS OF
VARIANCE DATA ON
NINE MODEL ENVIRONMENT INDICES
FOR THREE MODELS OF TEACHING AND NON-MODEL BEHAVIOR

INDEX 1: TEACHER TALK

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.63	.53	.56	.63	.59

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Subjects	.17	25		
Within Subjects	.35	78		
Columns	.20	3	.06	33.26*
Residual	.15	75	.00	
Total	.53	103		

INDEX 2: NEGOTIATED PROCEDURES, TEACHER

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.02	.14	.01	.03	.05

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Subjects	.03	25		
Within Subjects	.37	78		
Columns	.28	3	.09	75.50*
Residual	.09	75	.00	
Total	.41	103		

INDEX 3: NEGOTIATED PROCEDURES, STUDENT

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.00	.15	.00	.01	.04

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Subjects	.06	25		
Within Subjects	.64	78		
Columns	.41	3	.13	47.00 *
Residual	.22	75	.00	
Total	.70	103		

INDEX 4: HIGHER-LEVEL INFORMATION PROCESSING

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.07	.02	.27	.04	.10

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Subjects	.34	25		
Within Subjects	1.65	78		
Columns	1.01	3	.33	39.90*
Residual	.63	75	.00	
Total	1.99	103		

INDEX 5: MIDDLE-LEVEL INFORMATION PROCESSING

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.19	.04	.19	.11	.13

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Subjects	.28	25		
Within Subjects	.74	78		
Columns	.36	3	.12	23.31*
Residual	.38	75	.00	
Total	1.03	103		

INDEX 6: POSITIVE SANCTIONING

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.05	.02	.03	.05	.04

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Subjects	.03	25		
Within Subjects	.03	78		
Columns	.01	3	.00	16.73*
Residual	.02	75	.00	
Total	.07	103		

INDEX 7: NEGATIVE SANCTIONING

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.02	.02	.02	.02	.02

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Subjects	.01	25		
Within Subjects	.01	78		
Columns	.00	3	.00	.78
Residual	.01	75	.00	
Total	.02	103		

E-4

INDEX 8: INFORMATION PROCESSING

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.63	.31	.59	.59	.53

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Subjects	.76	25		
Within Subjects	2.37	78		
Columns	1.68	3	.56	61.30 *
Residual	.68	75	.00	
Total	3.13	103		

INDEX 9: PROCEDURAL

	Concept Attainment	Group Investigation	Synectics	Non-Model	Grand Mean
Mean	.12	.42	.12	.18	.21

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Square	F
Between Subjects	.33	25		
Within Subjects	2.15	78		
Columns	1.65	3	.55	82.13 *
Residual	.50	75	.00	
Total	2.49	103		

*Indicates significance at the .01 level.

Critical $F_{.99,(3,75)} = 4.06$

APPENDIX F

INFLUENCES OF THE INDICES OF BEHAVIOR ON EACH OTHER

One interesting question regarding classroom interaction is the influence of various aspects of behavior on one another. Table 21 presents the coefficients of correlation among the indices of the teacher-candidates in Non-Model practice.

Several influences are significant. As one might expect negotiated procedures on the part of the teacher (Index 2) positively influences the incidence of negotiated procedures on the part of students (Index 3). Second, Middle and Higher Level Information Processing (Indices 4 and 5)are negatively related to Negotiated Procedures of both teacher and students (Indices 2 and 3). This relationship probably reflects the shift to the content focus of the lesson, thus, reducing the amount of discourse about procedures. Third is the positive relationship between Higher-Level Information Processing (Index 5) and Middle-Level Information Processing (Index 4). Fourth, the amount of teacher talk (Index 1) is positively related to the amount of Negative and Positive Sanctioning (Index 6 and 9) indicating that increased teacher discourse is likely to be of the sanctioning sort, e.g., an increase in the evaluative role of the teacher. Finally, the finding that Information Processing (Index 8) is positively related to Positive Teacher Sanctioning (Index 6) probably reflects the predominance of the Recitation Style in which the Teacher asks a question, the student responds and the teacher reacts evaluatively.